CLAIMS

1. A plasma display panel (hereafter referred to as 'PDP') driving method for a PDP in which a plurality of discharge cells are arranged between a pair of substrates, the PDP driving method repeating the following steps to perform image display:

a set-up step for applying a set-up pulse to each of the plurality of discharge cells to accumulate a charge in each discharge cell;

a write step for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image; and

a discharge sustain step for applying at least one sustain pulse to each discharge cell after the write step to perform a sustain discharge in the selected discharge cells,

wherein the set-up pulse applied during the set-up step has a staircase waveform that rises in at least two steps.

2. The PDP driving method of Claim 1, wherein:

the staircase waveform for the set-up pulse is a staircase waveform that falls in at least two steps.

3. The PDP driving method of any one of Claims 1 and 2, wherein an average rate of change of voltage from the end of a first-step rise to the end of a second-step rise in the waveform

for the set-up pulse is no less than 1V/μs but no greater than 9V/μs.

4. The PDP driving method of any one of Claims 1 to 3, wherein a voltage jump for the first-step rise in the waveform for the set-up pulse is no less than V_f - 70V but no greater than V_f, when V_f is a discharge starting voltage.

5. A PDP driving method for a PDP in which a plurality of discharge cells are arranged between a pair of substrates, the PDP driving method repeating the following steps to perform image display:

a set-up step for applying a set-up pulse to each of the plurality of discharge cells to accumulate a charge in each discharge cell;

a write step for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image; and

a discharge sustain step for applying at least one sustain pulse to each discharge cell after the write step to perform a sustain discharge in the selected discharge cells,

wherein the set-up pulse applied during the set-up step has a staircase waveform that falls in at least two steps.

6. The PDP driving method of any one of Claim 1 and Claim 5, wherein the staircase waveform for the set-up pulse is generated by adding at least two pulses and applying the

resulting pulse.

7. A PDP driving method, for a PDP in which a plurality of discharge cells are arranged between a pair of substrates, the PDP driving method repeating the following steps to perform image display:

a write step for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image; and

a discharge sustain step for applying at least one sustain pulse to each discharge cell after the write step to perform a sustain discharge in the selected discharge cells;

wherein the write pulse applied in the write step has a staircase waveform that falls in at least two steps.

8. The PDP driving method of Claim 7, wherein the staircase waveform of the write pulse applied in the write step rises in at least two steps.

9. The PDP driving method of any one of Claim 7 and Claim 8, wherein a voltage jump for a second-step rise in the waveform for the write pulse is no less than 10V but no greater than 100V.

10. A PDP driving method, for a PDP in which a plurality of discharge cells are arranged between a pair of substrates, the

PDP driving method repeating the following steps to perform image display:

a write step for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image; and

a discharge sustain step for applying at least one sustain pulse to each discharge cell after the write step to perform a sustain discharge in the selected discharge cells;

wherein the write pulse applied in the write step has a staircase waveform that rises in at least two steps.

11. The PDP driving method of any one of Claim 7 and Claim 10,

wherein the staircase waveform of the write pulse in the write step is generated by adding at least two pulses and applying the resulting pulse.

12. A PDP driving method for a PDP in which a plurality of discharge cells are arranged between a pair of substrates, the PDP driving method repeating the following steps to perform image display:

a write step for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image; and

a discharge sustain step for applying at least one sustain

pulse to each discharge cell after the write step to perform a sustain discharge in the discharge cells;

wherein the sustain pulses applied in the sustain step have a staircase waveform that rises in at least two steps.

13. The PDP driving method of Claim 12, wherein:

the staircase waveform for the sustain pulses falls in at least two steps.

14. The PDP driving method of Claim 12, wherein, a voltage for a first-step rise in the waveform for the sustain pulses is no less than V_f - 20V but no greater than V_f + 30V, when V_f is a discharge starting voltage.

15. The PDP driving method of any one of Claims 12 to 14, wherein a time from the end of the first-step rise to the start of a second-step rise in the waveform for the sustain pulses is no less than T_{df} - 0.2μs but no more than T_{df} + 0.2μs, when T_{df} is a discharge delay time due to the sustain pulses.

16. A PDP driving method, for a PDP in which a plurality of discharge cells are arranged between a pair of substrates, the PDP driving method repeating the following steps to perform image display:

a write step for applying a write pulse to selected

discharge cells of the plurality of discharge cells to write an image; and

a discharge sustain step for applying at least one sustain pulse to each discharge cell after the write step to perform a sustain discharge in the selected discharge cells;

wherein the sustain pulses applied in the sustain step have a staircase waveform that falls in at least two steps.

17. The PDP driving method of any one of Claim 12 and Claim 16, wherein a maximum voltage for the sustain pulses is no less than V_f but no greater than V_f + 150V, when V_f is a discharge starting voltage.

18. The PDP driving method of Claim 12, wherein a second-step rise of the waveform for the sustain pulses corresponds to a continuous function.

19. The PDP driving method of Claim 18, wherein a second-step rise of the waveform for the sustain pulses is performed between an end of a charge period in which the discharge cells are charged to geometrical capacity, and an end of a discharge current.

20. The PDP driving method of Claim 18, wherein the second-step rise of the waveform for the sustain pulses is performed between the end of a charge period in which the discharge cells are charged to capacity, and an end of a

discharge current.

21. The PDP driving method of Claim 18, wherein in the waveform for the sustain pulses:

a first-step rise corresponds to a trigonometric function and is completed between a time at which a discharge current starts to flow and a time at which the discharge current reaches a maximum value; and

a second-step rise is started between a time at which the discharge current reaches a maximum value and an end of the discharge current.

22. The PDP driving method of any one of Claims 18 to 21, wherein a first-step fall in the waveform for the sustain pulses descends to around of a minimum discharge sustain voltage, a rate of descent corresponding to a trigonometric function.

23. The PDP driving method of Claim 18, wherein a second-step rise in the waveform for the sustain pulses is corresponds to an exponential function.

24. A PDP driving method, for a PDP in which a plurality of discharge cells are arranged between a pair of substrates, the PDP driving method repeating the following steps to perform image display:

a write step for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an

image; and

a discharge sustain step for applying at least one sustain pulse to each of the plurality of discharge cells after the write step to perform a sustain discharge in the discharge cells corresponding to the written image;

wherein the waveform for the sustain pulses applied in the sustain step is set such that a voltage applied when a discharge current is highest is higher than a voltage at the discharge starting point.

25. The PDP driving method of Claim 24, wherein:

the rise portion of the waveform for the sustain pulses is in the form of a linear or approximately linear slope that has a constant gradient.

26. The PDP driving method of any one of Claims 12, 16 and 24, wherein the waveform for each sustain pulse is such that a phase for a variation in the discharge current is set earlier that a phase for variation in a voltage applied to the discharge cells during a period in the pulse between a point where a discharge current starts and a point where the discharge current reaches a peak value.

27. The PDP driving method of any one of Claims 12, 16 and 24, wherein the waveform for the sustain pulses in the sustain step is generated by adding at least two pulses and applying the resulting pulse.

28. A PDP driving method, for a PDP in which a plurality of discharge cells are arranged between a pair of substrates, the PDP driving method repeating the following steps to perform image display:

a write step for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image; and

a discharge sustain step for applying at least one sustain pulse to each discharge cell after the write step to perform a sustain discharge in the selected discharge cells;

wherein a first sustain pulse applied in the sustain step has a staircase waveform in which at least one of the rising and falling portions is performed in at least two steps.

29. The PDP driving method of Claim 28, wherein the first sustain pulse applies a maximum voltage for at least $0.1\mu s$ longer than for each of second and subsequent sustain pulses.

30. The PDP driving method of any one of Claims 28 and 29, wherein the first sustain pulse applies the maximum voltage for at least is $0.02\mu s$ but for no longer than 90% of a pulse width *PW*.

31. The PDP driving method of any one of Claims 12, 16 and 24, wherein in the sustain step, the waveform for the sustain pulses is generated by adding at least two pulses and applying

the resulting pulse.

32. A PDP driving method, for a PDP in which a plurality of discharge cells are arranged between a pair of substrates, the PDP driving method repeating the following steps to perform image display:

a write step for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image;

a discharge sustain step for applying at least one sustain pulse to each discharge cell after the write step to perform a sustain discharge in the selected discharge cells; and

an erase step for applying an erase pulse to each discharge cell after the discharge sustain step to erase the image,

wherein the erase pulse applied in the erase step has a staircase waveform that rises in at least two steps.

33. The PDP driving method of Claim 32, wherein a voltage in a first-step rise in the waveform for the erase pulse is no less than V_f - 50V but no greater than V_f + 30V , when V_f is a discharge starting voltage.

34. The PDP driving method of any one of Claim 32 and Claim 33, wherein a voltage in a first-step rise in the waveform for the erase pulse is no less than V_f but no greater than V_f + 100V, when V_f is a discharge starting voltage.

35. A PDP driving method, for a PDP in which a plurality of discharge cells are arranged between a pair of substrates, the PDP driving method repeating the following steps to perform image display:

a write step for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image;

a discharge sustain step for applying at least one sustain pulse to each discharge cell after the write step to perform a sustain discharge in the selected discharge cells; and

an erase step for applying an erase pulse to each discharge cell after the discharge sustain step to erase the image,

wherein the waveform for the erase pulse applied in the erase step is a staircase waveform that rises in at least two steps; and

a time between a rise of the erase pulse and a point at which a maximum voltage ceases to be applied is no less than T_{df} - 0.1μs but no greater than T_{df} + 0.1μs, when T_{df} is a discharge delay time for the pulse.

36. The PDP driving method of Claim 35, wherein a first-step rise of the waveform for the erase pulse no less than V_f but no greater than V_f + 100V, when V_f is a discharge starting voltage.

37. The PDP driving method of any one of Claim 32 and Claim 35, wherein the waveform for the erase pulse in the erase

step is generated by adding at least two pulses and applying the resulting pulse.

38. A PDP driving method for a PDP in which a plurality of discharge cells are arranged between a pair of substrates, the PDP driving method repeating the following steps to perform image display:

a set-up step for applying a set-up pulse to each of the plurality of discharge cells to accumulate a charge in each discharge cell;

a write step for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image;

a discharge sustain step for applying at least one sustain pulse to each discharge cell after the write step to perform a sustain discharge in the selected discharge cells, and

an erase step for applying an erase pulse to each discharge cell after the discharge sustain step to erase the image,

wherein the waveforms for the set-up pulse applied in the set-up step, the write pulse applied in the write step, the first sustain pulse applied in the sustain step and the erase pulse applied in the erase step is a staircase waveform in which at least one of the rising and falling portions is performed in at least two steps.

39. A PDP driving method for a PDP in which a plurality of discharge cells are arranged between a pair of substrates, the

PDP driving method repeating the following steps to perform image display:

a set-up step for applying a set-up pulse to each of the plurality of discharge cells to accumulate a charge in each discharge cell;

a write step for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image;

a discharge sustain step for applying at least one sustain pulse to each discharge cell after the write step to perform a sustain discharge in the selected discharge cells , and

an erase step for applying an erase pulse to each discharge cell after the discharge sustain step to erase an image,

wherein the waveforms for the set-up pulse applied in the set-up step, the write pulse applied in the write step, the sustain pulses applied in the sustain step and the erase pulse applied in the erase step is a staircase waveform in which at least one of the rising and falling portions is performed in at least two steps.

40. The PDP driving method of any one of Claims 1, 5, 6, 8, 11, 12, 16, 24, 28, 32, 35, wherein a discharge gas is enclosed in each of the discharge cells in the PDP at a pressure of 800 to 4 000 torr.

41. The PDP driving method of Claim 40, wherein an inert gas mixture including helium, neon, xenon and argon is used as

the discharge gas.

42. The PDP driving method of any one of Claim 40 and Claim 41, wherein the discharge gas is a mixture containing not more than 5% xenon, not more than 0.5% argon and less than 55% helium.

43. A PDP display apparatus, comprising:

a PDP in which a plurality of discharge cells are arranged between a pair of substrates; and

a driving apparatus including:

a set-up unit for applying a set-up pulse to each of the plurality of discharge cells to accumulate a charge in each discharge cell;

a write unit for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image; and

a discharge sustain unit for applying at least one sustain pulse to each of the plurality of discharge cells to perform a sustain discharge in the discharge cells corresponding to the written image,

wherein the set-up unit includes a pulse adding means for generating the set-up pulse by adding at least two pulses.

44. A PDP display apparatus, comprising:

a PDP in which a plurality of discharge cells are arranged between a pair of substrates; and

a driving apparatus including:

a write unit for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image; and

a discharge sustain unit for applying at least one sustain pulse to each of the plurality of discharge cells to perform a sustain discharge in the discharge cells corresponding to the written image,

wherein the write unit includes a pulse adding means for generating the write pulse by adding at least two pulses.

45. A PDP display apparatus, comprising:

a PDP in which a plurality of discharge cells are arranged between a pair of substrates; and

a driving apparatus including:

a write unit for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image; and

a discharge sustain unit for applying at least one sustain pulse to each of the plurality of discharge cells to perform a sustain discharge in the discharge cells corresponding to the written image,

wherein the discharge sustain unit includes a adding means for generating the each sustain pulse by adding at least two pulses.

46. A PDP display apparatus, comprising:

a PDP in which a plurality of discharge cells are arranged between a pair of substrates; and

a driving apparatus including:

a write unit for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image;

a discharge sustain unit for applying at least one sustain pulse to each of the plurality of discharge cells to perform a sustain discharge in the discharge cells corresponding to the written image; and

an erase unit for applying an erase pulse to each of the plurality of discharge cells to erase an image,

wherein the erase unit includes a pulse adding means for generating the erase pulse by adding at least two pulses.

47. A PDP display apparatus, comprising:

a PDP in which a plurality of discharge cells are arranged between a pair of substrates; and

a driving apparatus including:

a write unit for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image; and

a discharge sustain unit for applying at least one sustain pulse to each of the plurality of discharge cells to perform a sustain discharge in the discharge cells corresponding to the written image,

wherein the waveform for the write pulse applied by the

write unit and the sustain pulses applied by the discharge sustain unit have staircase waveforms in which at least one of the rising and falling portions has at least two steps.

48. A PDP display apparatus, comprising:

a PDP in which a plurality of discharge cells are arranged between a pair of substrates; and

a driving apparatus including:

a set-up unit for applying a set-up pulse to each of the plurality of discharge cells to accumulate a charge in each discharge cell;

a write unit for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image;

a discharge sustain unit for applying at least one sustain pulse to each of the plurality of discharge cells to perform a sustain discharge in the discharge cells corresponding to the written image; and

an erase unit for applying an erase pulse to each of the plurality of discharge cells to erase an image,

wherein the set-up pulse applied by the set-up unit, the write pulse applied by the write unit, the first sustain pulse applied by the discharge sustain unit and the erase pulse applied by the erase unit have staircase waveforms in which at least one of the rising and falling portions is performed in at least two steps.

49. A PDP display apparatus, comprising:

a PDP in which a plurality of discharge cells are arranged between a pair of substrates; and

a driving apparatus including:

a set-up unit for applying a set-up pulse to each of the plurality of discharge cells to accumulate a charge in each discharge cell;

a write unit for applying a write pulse to selected discharge cells of the plurality of discharge cells to write an image;

a discharge sustain unit for applying at least one sustain pulse to each of the plurality of discharge cells to perform a sustain discharge in the discharge cells corresponding to the written image; and

an erase unit for applying an erase pulse to each of the plurality of discharge cells to erase an image,

wherein the set-up pulse applied by the set-up unit, the write pulse applied by the write unit, and the sustain pulses applied by the discharge sustain unit and the erase pulse applied by the erase unit have staircase waveforms in which at least one of the rising and falling portions is performed in at least two steps.

50. The PDP display apparatus of any one of Claims 48 and 49, wherein the discharge gas is enclosed in each of the discharge cells in the PDP at a pressure of 800 to 4 000 torr.